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EVALUATION OF ALTERNATIVES MEMORANDUM
REVISED REMEDIAL ACTION

ENVIRO-CHEM SUPERFUND SITE
ZIONSVILLE, INDIANA

PREPARED FOR

ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION TRUST

PREPARED BY

AWD TECHNOLOGIES, INC.
PITTSBURGH, PENNSYLVANIA

AWD PROJECT NUMBER 2455.001

DECEMBER 1994

AWD TECHNOLOGIES

A Subsidiary of
The Dow Chemical Company

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The Dow Chemical Company

PGH-94-MJD-1308

December 16, 1994

Mr. Dion Novak
U.S. Environmental Protection Agency
Region V
77 West Jackson Boulevard
HSRL-6J
Chicago, Illinois 60604

Subject: Enviro-Chem Superfund Site
Revised Draft Evaluation of Alternatives Memorandum
Revised Remedial Action
AWD Project Number 2455.001

Dear Mr. Novak:

Enclosed are three (3) copies of the Revised Draft Evaluation of Alternatives Memorandum - Revised Remedial Action (RRA) for the Enviro-Chem Superfund Site. This revision addresses the U.S. EPA comments contained in the letter correspondence of November 2, 1994 and as discussed in the November 23 meeting at U.S. EPA offices. Responses to the U.S. EPA letter comments are as follows. The U.S. EPA comments are referenced to the correspondence and have not been restated here.

U.S. EPA Comment - General

Response:

The Revised Draft Evaluation of Alternatives Memorandum (EAM) includes a justification for why there must be a deviation from the Consent Decree to remediate the south end of the site. This justification is contained in Sections 2.1 and 4.4.2 of the EAM.

The EAM is basically an evaluation of five Remedial Action Alternatives for the purpose of selecting the most appropriate remedy for the site. The alternatives analyses has been revised to be in the form of an Engineering Evaluation and Cost Analyses (EE/CA), with modifications as discussed in the November 23 meeting. The following sections are included in the revision:

AWD Technologies, Inc.
Penn Center West Building III Suite 300 Pittsburgh Pennsylvania 15276 Telephone 412 788 2717 Fax 412 788 1316

- Site Characterization
- Revised Remedial Action Scope and Objectives (with reference to the RRA schedule)
- Identification and Analyses of Revised Remediation Action Alternatives (including capital, O&M, and present-worth costing)
- Comparative Analysis of Revised Remedial Action Alternatives
- Recommended Revised Remedial Action

A summary of the site conditions in the southern concrete pad area has been provided with a discussion of the basis for proposing the RRA. Site characterization information typically presented in an EE/CA analyses has been referenced to specific site investigation documents.

The revised evaluation has more detailed descriptions of each alternative, including figures depicting plan views and details, ARARs analyses of offsite disposal of groundwater and soils, and detailed estimates for capital and operation maintenance costs. We believe this addresses U.S. EPA's comments on the lack of descriptive information on the alternatives.

U.S. EPA Specific Comments and Responses

Comment: Page 1-1, Paragraphs 1 and 4

Response:

The site conditions are now better defined as a result of the November 1994 concrete pad area investigation. This investigation provided new data that indicates the presence of sand deposits in the lower portion of the proposed zone of SVE treatment, in the eastern area of the concrete pad. This sand deposit may be hydraulically connected to the sand waterbearing zone beneath the till. The investigation also confirmed that the potentiometric surface of the sand waterbearing zone is 4 to 6 feet below ground surface.

The implication of these findings is twofold. First, the proposed Remedial Action as outlined in the Consent Decree cannot be said to be technically feasible under these conditions. The effectiveness of SVE in a saturated zone is uncertain, and the costs for construction and operation of the remedial action would be increased very significantly. Second, the proposed Revised Remedial Action excavation approach in the southern concrete pad area will now need to be modified to include provisions for dewatering the sand waterbearing zone, such as steel sheet pile cutoffs and dewatering.

A discussion of site conditions in the southern concrete pad area, including historical data, and the basis for revising the RRA is contained in Section 2.0 Site Characterization, of the revised evaluation memorandum.

Comment: Page 1-1, Paragraph 2

Response:

Alternative Number 4 has been included in the memorandum to address SVE of the southern area in conjunction with dewatering of the shallow groundwater.

Comment: Page 2-1, Bullets

Response:

Additional site documents have been included in the site characterization references.

Comment: Page 3-1, Bullets

Response:

The RCRA cap option on the southern area has been included in the description of RRA Alternatives 2 and 3 that include excavation of that area. Capping the southern area will be based on the results of exit soil sampling conducted in the excavation as discussed in the November 23 meeting.

Comment: Page 4-1

Response:

This has been evaluated as Alternative Number 4. Also see the response to Comment Page 3-1.

Comment: Page 4-3 and successive pages

Response:

Present worth costs have been estimated for each alternative and are summarized on Table 5-1 of the evaluation memorandum.

Comment: Page 4-4, Paragraph 2

Response:

The offsite disposal of contaminated media and the LDRs are discussed in Sections 4.1.1.1 and 4.2.1.1 of the evaluation memorandum.

Comment: Page 4-5, top Paragraph and page 4-6, Paragraph 1

Response:

The contaminated groundwater for Alternative Numbers 2 and 3 would come from two sources:

1. Excavation dewatering
2. SVE system operations

The basis for the groundwater volumes is described under each alternative in the evaluation memorandum.

Comment: Page 4-6, Sections 4.4 and 4.5

Response:

The RRA Alternatives focus on options for the southern site area. The remaining site area (north) will be remediated by SVE as described in the Consent Decree, except when the RRA Alternative affects operations in the northern site area (Alternative Number 3) or when SVE was eliminated from the alternative (Alternative Number 1).

The effect of soil heterogeneity on SVE operations has been discussed under Alternative Number 3 because of the new conditions presented by the fill materials being placed in the northern site area. Soil condition affects on air sparging have also been discussed under Alternative Number 5. The affect of insitu soil conditions (in the north site area) on SVE performance will be addressed in the design and operation of the SVE system. The SVE performance specification design approach will be used to develop the most effective SVE system for the site conditions (see Section 4.3.1 of the evaluation memorandum).

Bioremediation has not been included in the evaluation since it is not considered a qualified technology appropriate for the conditions in the southern site area. The primary reasons for not evaluating this technology, as discussed in the July 1994 EAM, include:

- Low permeability clayey soils limit oxygen and nutrient transfer insitu, and thus bioreactions would be very slow. Soil fracturing or other in-situ physical soil mixing techniques would be needed to improve soil conditions and enhance bioactivity.

- Fine-grained soils have a high potential for bioclogging which further reduces oxygen and nutrient transfer.

- Degradation of chlorinated organics insitu has not been demonstrated full-scale in the field. There are virtually no well-documented applications at present that can be used for feasibility study evaluations, design and cost estimating purposes.

Comment: Page 5-1, Paragraph 2

Response:

The low permeability barrier will be placed on a slope of approximately 26 degrees (2H:1V) or flatter to allow construction of the synthetic membrane. The low permeability barrier and southern area excavation approach are described under Alternative Numbers 2 and 3 in the evaluation memorandum.

Comment: Page 5-1, Paragraph 3

Response:

The cover for the selected alternative (Number 3) is proposed as a RCRA Subtitle C cap that is a modification of the Consent Decree cap. The proposed modifications and their rationale are described in Section 4.3.1.1 of the evaluation memorandum.

Comment: Page 5-2, 2nd Bullet

Response:

The southern area excavation approach is described under Alternative Numbers 2 and 3 in the evaluation memorandum.

Comment: Page 5-2, Last Bullet

Response:

Cover materials for the southern excavation area will be based on post-excavation soil sampling results as discussed in the November 23 meeting at U. S. EPA. The cover design and the soil criteria for capping the excavation area will be described in the revised Preliminary Design to be submitted to U.S. EPA on January 31, 1995.

We trust this addresses U.S. EPA comments in the Evaluation of Alternatives Memorandum - RRA. If you have any questions or comments on this matter, please feel free to call me at (412) 788-2717.

Sincerely,

Mark J Dowiak

Mark J. Dowiak, P.E.
Project Manager

MJD/rks

cc: T. Likins, IDEM
R. O. Ball, ERM-North Central
N. W. Bernstein, N. W. Bernstein & Associates
J. M. Kyle, Barnes and Thornburg

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FIGURES

NUMBER

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TABLES

NUMBER

5-1	Revised Remedial Action Alternatives Comparative Cost Summary

1.0 INTRODUCTION

This Evaluation of Alternatives Memorandum has been prepared to: (1) summarize the need for revision to the remedial action for the Enviro-Chem Superfund Site as presently described in the Enviro-Chem Site Consent Decree, Exhibit A, and (2) to document the consideration of the alternative remedial approaches to achieve the Consent Decree cleanup standards set forth in Exhibit A.

During the pre-design activities conducted by AWD Technologies, Inc. (AWD) on behalf on the Enviro-Chem Trust (Trustees) in September 1992 and January 1993, the southern portion of the site beneath the concrete pad was found to be water saturated. Phase I and II Supplemental Investigations conducted by AWD confirmed that the shallow groundwater zone at the site was within the proposed SVE zone of treatment. In a November/December 1994 concrete pad area investigation, waterbearing sand was found to be closer to the surface on the eastern side of the pad area than previous expected. This sand layer may be hydraulically connected to the main waterbearing sand zone beneath the till. The combination of the saturated conditions in the pad area, the recently detected sand layer, and revised estimates of discharge rates that would be encountered if vapor extraction trenches were attempted to be dug in the sand layer, presents two major implications for Remedial Action at the site:

1. The proposed Remedial Action as outlined in the Consent Decree would be very difficult to implement under these conditions, and it cannot be said to be technically feasible. No assurance can be given that it would achieve Consent Decree Exhibit A cleanup levels. Additionally, the costs for construction and operation of the Remedial Action would be increased significantly.

2. The proposed Revised Remedial Action (RRA) excavation design in the southern concrete pad area would need to be modified to include provisions for sheetpile cutoff walls in the areas of the site where shallow sand deposits are present.

The Exhibit A remedy has been modified in the proposed RRA to address the concrete pad and soils in the pad area by excavating and depositing these materials onto the northern portion of the site for treatment by SVE rather than in-situ SVE of the area. The excavation will be backfilled with native soils. The SVE system will be designed by performance specifications rather than specifying the injection/extraction trench method only. Additionally, modifications ~~have been~~ made, among other things, to the design and the timing of cap construction. The water problem in the pad area to be excavated will be addressed by the use of sheetpiling in the eastern portion of the pad area.

This document summarizes the various alternatives to the Exhibit A remedy that have been evaluated and sets forth the evaluation process. The RRA selected as a result of this evaluation will be further described in the Revised Draft Preliminary Design (30 Percent) Report to be submitted to U.S. EPA on January 31, 1995.

2.0 SITE CHARACTERIZATION

Site conditions have been characterized by means of a Remedial Investigation conducted by U.S. EPA, an SVE pilot study conducted by Terra Vac (for ERM-North Central, Inc.) and Supplemental Site Investigations conducted by AWD for the Trustees. These investigations are described in the following documents:

- Final Remedial Investigation Report, Volumes 1 and 2, CH2M Hill, March 14, 1986.
- Interim Report of Vapor Extraction Pilot Test, ERM-North Central, Inc., July 8, 1988 (Attachment 1 of Exhibit A to the Consent Decree).
- Technical Memorandum Number 2, Geotechnical Hydrogeological and Supplemental Pre-Design Investigation, Northside Sanitary Landfill/ ECC Corporation, CH2M Hill, November 9, 1988.
- Supplemental Investigation Summary Report, Phase I, AWD Technologies, Inc., October 1992.
- Supplemental Site Investigation Report, Phase II, AWD Technologies, Inc., March 1993.
- Preliminary Data - Concrete Pad Area Investigation, AWD Technologies, Inc., November 1994.

EE/CA site characterization information can be found in these documents as follows:

- Site Description and Background - Final RI Report, Chapters 3 and 4, Supplemental Site Investigation Reports, Phases I and II.
- Analytical Data - Final RI Report, Chapter 4.

- Source, Nature, and Extent of Contamination - Final RI Report, Chapter 5, including Appendix C and Appendix A (Technical Memorandum).

- Risk Assessment - Final RI Report, Chapter 6, including Appendices D and E.

The referenced documents, including the Revised Draft Preliminary Design (30 Percent) Report for the RRA, January 1995, should be consulted for detailed descriptions of previous site investigations.

2.1 Justification for Revising the Remedial Action

The site conditions were reevaluated as a result of the Supplemental Investigations in 1992 and 1993. The Concrete Pad Area Investigations performed in November 1994 confirmed the findings of the supplemental investigations concerning the groundwater conditions in the sand waterbearing zone, and provided data indicating the presence of sand deposits in the lower portion of the proposed zone of SVE treatment (0 to 9 feet BGS).

These sand deposits were found at 8 feet BGS in the eastern area of the concrete pad (OW-4) and 20 feet BGS in the western area of the pad (OW-3).

The reevaluation of site conditions indicated that:

- "Elevated" shallow groundwater conditions (4 to 5 feet BGS) were present in the glacial till, within the proposed zone of treatment (0 to 9 feet BGS).

- The southern concrete pad subbase aggregate was saturated.

- The potentiometric groundwater surface in the sand waterbearing zone occurring beneath the till was within 4 to 6 feet of the ground surface.

- Sand deposits are present at 8 feet BGS (OW-4) within the originally proposed zone of SVE treatment (0 to 9 feet BGS) in the eastern area of the concrete pad. These deposits may be hydraulically connected to the sand waterbearing zone beneath the till.

The remedial action soil vapor extraction (SVE) system was developed based on pilot testing conducted in 1988. A pilot test was conducted by Terra-Vac as a subcontractor to ERM-North Central, Inc. The purpose of the pilot test was to determine the feasibility and the cost of a full-scale SVE system. The pilot test was conducted in the northern part of the site using two 40-foot long trenches excavated to a depth of 9 feet. Field observations indicated that a small amount of water (<2 gallons) was encountered in one trench during excavation. The trenches were equipped with piping and were backfilled with aggregate. A lower pipe set at a depth of 8 feet BGS was installed to collect groundwater during the test.

The SVE system presented in the Consent Decree, Exhibit A, used a series of injection and extraction trenches across the site at 19-foot spacings and an average depth of 9 feet. A water collection system was included in the SVE trench design, however, this system was not intended to collect significant groundwater discharge volume. The primary intent of the water collection system was to remove water present in the extracted vapor during SVE operation.

AWD was contracted by the Trustees in 1992 to perform the Remedial Design for the site. AWD recommended to the Trustees that additional shallow groundwater data be obtained prior to design of the remedial action, since the existing database from the RI and the pilot test was limited with respect to the presence of groundwater in the proposed SVE zone of treatment. Subsequently, in the Phase I (October 1992) and Phase II (March 1993) Supplemental Investigations, AWD determined that "elevated" shallow groundwater conditions were present onsite, especially in the area of the southern concrete pad.

Static water levels in the till unit (above the sand waterbearing zone) were found to be approximately 5 feet BGS at most locations, except in the southern concrete pad area where the till water table is in hydraulic communication with overlying saturated aggregate subbase beneath the concrete pad. In this location, shallow groundwater levels were found within 0.5 feet BGS (top of concrete). Because of these conditions, the Remedial Action SVE system was reevaluated with respect to water collection in the 9-foot deep trenches. A total system water production rate of 5.5 gpm was estimated in the Phase II Supplemental Investigation. This included an estimated discharge of 3.5 gpm from the shallow groundwater in the till zone and 2.0 gpm from upward leakage through the till from the underlying sand waterbearing zone. The aggregate subbase beneath the concrete pad was assumed to be dewatered during construction, and was not included as a long-term source of water to the SVE system.

After internal evaluations of various options to address the shallow groundwater conditions and its impact on the Consent Decree Remedial Action, an alternative approach to the Consent Decree was identified and the Trustees proposed the Revised Response Action (RRA) to U.S. EPA in an October 11, 1993 correspondence. The RRA proposed excavation of the southern concrete pad area instead of SVE. It also included modifications to the SVE method because of the effects of placing 5 to 8 feet of contaminated fill material in the northern part of the site area. An alternative approach to the cap was also included. The proposed RRA, including the modifications to the SVE system and the final cap, is described under RRA Alternative Number 3 in this evaluation. The modifications to the cap are described under RRA Alternative Number 2 in this evaluation.

In November 1994, AWD performed additional investigations in the southern concrete pad area to evaluate the subsurface conditions with respect to the proposed excavation to 9 feet BGS, especially with respect to potential uplift of the excavation floor because of the potentiometric surface in the underlying sand waterbearing zone.

Three wellpoints, OW-3, OW-4, and OW-5 were placed on the east, west, and south sides of the concrete pad, into the sand waterbearing zone. Undisturbed samples were taken from the till unit overlying the sand zone for geotechnical testing. Preliminary data from the investigation confirms that the potentiometric surface in the waterbearing zone is 4 to 5 feet BGS in the area of the southern concrete pad. Additionally, shallow sand deposits were found east of the pad (OW-5), at depths of 8 feet BGS. These deposits may be hydraulically connected to the sand waterbearing zone. These shallow sands have major implications on the Consent Decree Remedial Action as follows:

1. The Remedial Action would be very difficult to implement because the shallow sands would be penetrated by the SVE trenches. This would result in significantly increased construction costs to install the trenches, and significantly increased operation costs due to ongoing dewatering of the trenches during SVE.

2. SVE within a saturated sand zone cannot be said to be technically feasible. Pilot studies using SVE in an active dewatered saturated zone have not been performed. No assurances can be given that the SVE would be effective in achieving the Consent Decree Exhibit A cleanup levels.

The findings of the concrete pad area investigations will be used to revise the RRA Preliminary Design (30 Percent) with respect to the southern concrete pad area to enable excavation to 9 feet BGS. This revised design is planned for January 31, 1995 submittal to U.S. EPA.

3.0 REVISED REMEDIAL ACTION OBJECTIVES AND SCOPE

The nature and extent of site hazards summarized in the Feasibility Study form the basis for identifying general objectives for the site soil and groundwater. The general objectives for the site are listed below:

1. Soil

- Minimize Direct Contact - Minimize risk to public health from direct contact with soil or risks associated with dust generation or volatilization of contaminants.

- Control Migration to Groundwater - Minimize leaching of contaminants from soil to groundwater to adequately protect public health.

- Control Migration to Surface Water - Minimize overland migration of contaminants from soil to the unnamed ditch, Finley Creek, or Eagle Creek to adequately protect public health and the environment.

2. Groundwater

- Minimize Consumption of Contaminants - Minimize risk to public health from future direct consumption of contaminated groundwater.

- Control Migration to Surface Water - Manage migration of contaminated groundwater to the unnamed ditch, Finley Creek, or Eagle Creek so public health and the environment are adequately protected from surface water and sediment contamination and ingestion of contaminated aquatic life.

Each general remedial objective is stated in terms of actions, including no action, that can be accomplished and not in terms of absolute removal, or restoration to pristine conditions. The objectives reflect the NCP objectives to "mitigate and minimize threats" and "provide(s) adequate protection."

The scope of the RRA was developed to meet all of the general remedial objectives described above and to achieve the cleanup objectives of the Remedial Action Plan (RAP) described in the Consent Decree, Exhibit A. The basic RRA components include soil vapor extraction (SVE), capping, and monitoring.

Proposed revisions to the RAP for the recommended RRA (RRA Alternative Number 3) include the following:

- Excavation of the southern concrete pad, subbase aggregate, and subsurface soils and placement of these materials onto the northern portion of the site for subsequent SVE treatment rather than in-situ SVE of the area.
- Trustee cooperation with U.S. EPA's intention to perform exit sampling of soils in the excavation area.
- Backfill of the excavation with native soils.
- Modification of the RCRA-compliant cover on the backfilled excavation area.

3.1 Objectives of the Revised Remedial Action

The objective of the RRA is to:

- Meet the "Site-Specific Acceptable Concentrations" listed in Table 3-1 of Exhibit A.

These objectives are considered appropriate for the RRA. ?

3.2 Remedial Action Schedule

A draft schedule for Remedial Action was submitted to U.S. EPA on October 13, 1994. The schedule contains both start and completion times for the Remedial Design and Remedial Action Construction. U.S. EPA commented on the draft schedule in a November 15, 1994 correspondence. The final schedule is expected to be developed after U.S. EPA approval of the Preliminary Design (30 percent) for the RRA.

4.0 IDENTIFICATION AND ANALYSES OF REVISED REMEDIAL ACTION ALTERNATIVES

A number of site-wide Revised Remedial Action alternatives were carefully evaluated to address the conditions in the southern concrete pad area. Where practicable, the alternatives considered the CERCLA preference for treatment of contaminated materials over conventional containment or land disposal approaches to address the principal threat at the site, which are volatile organic compounds (VOCs). Public health and environmental endangerment assessments related to the VOCs, and other site contaminants, are contained in the Remedial Investigation Report.

Based on the available information on site conditions and the contaminant characteristics, only the most qualified technologies appropriate for the site ~~have been~~ identified for analyses. The technologies identified for further evaluation in the southern site area, as an alternative to the Consent Decree Remedial Action, include the following:

1. Subsurface interceptor drain in the shallow groundwater.
2. Excavation of the concrete pad, subbase, and subsoils with offsite disposal.
3. Excavation with onsite placement and SVE treatment of the excavated materials.
4. Soil vapor extraction (SVE) with active dewatering to lower the shallow groundwater table.
5. Air sparging of the shallow groundwater zone in conjunction with SVE.

These technologies were used for the southern site area in conjunction with the basic Consent Decree SVE approach for the remainder of the site to develop the Revised Remedial Action Alternatives evaluated herein.

Potential Revised Remedial Action alternatives evaluated included the following:

- RRA Alternative Number 1 - Groundwater interceptor drain with the Consent Decree RCRA-compliant cover over the entire site area with no SVE treatment of soils in the site area north of the concrete pad ("additional work" measure described in Exhibit A).

- RRA Alternative Number 2 - Excavation of the southern concrete pad, aggregate subbase, and underlying subsoils with offsite disposal at a RCRA-permitted facility, and SVE treatment with the Consent Decree RCRA-compliant cover for the remaining site area.

- RRA Alternative Number 3 - Excavation of the southern concrete pad, aggregate subbase, and underlying subsoils and SVE treatment of these excavated materials in the northern site area, along with a RCRA-compliant covering of the remaining site area.

- RRA Alternative Number 4 - Soil vapor extraction of the entire site area with shallow groundwater dewatering and the Consent Decree RCRA-compliant cover over the entire site area.

- RRA Alternative Number 5 - Air sparging of the southern concrete pad area with SVE treatment and the Consent Decree RCRA-compliant cover for the remaining site area.

The criteria used in the analyses of these alternatives generally followed the U.S. EPA Engineering Evaluation/Cost Analyses (EE/CA) for ~~conducting~~ non-time-critical removal actions under CERCLA. The criteria include:

1. Effectiveness

   - Protectiveness (Long and Short Term)
   - Ability to Achieve Cleanup Objectives
   - Compliance with ARARs
   - Reduction of Toxicity, Mobility, or Volume through Treatment

2. Implementability

   - Technical Feasibility
   - Availability
   - Administrative Feasibility

3. Cost

- Capital Cost
- Operation, Maintenance, and Monitoring Costs

A description and analysis of each RRA alternative is included in the following sections. A comparative analyses of the alternatives is contained in Section 5.0.

4.1 RRA Alternative Number 1

4.1.1 Description

RRA Alternative Number 1 involves placement of a shallow groundwater interceptor drain downgradient of the southern concrete pad area as a substitute for SVE of the site. The remaining northern portion of the site soils would be not vapor extracted and the entire site would be covered with the Consent Decree RCRA-compliant cover. This alternative is the additional work measure described in the Consent Decree, Exhibit A. RRA Alternative Number 1 is shown on Figure 4-1.

The interceptor drain would be set at a depth of 2 feet or greater above the sand waterbearing zone. The depth BGS would vary from approximately 6 to 16 feet based on site conditions. The drain flow rate has been estimated to be 2 gpm based on the shallow groundwater system storage and permeability as estimated during the Phase II Supplemental Investigations. The drain includes two collection sumps with submersible pumps and automatic control systems. A 100,000-gallon storage tank system is included to provide a minimum 30-day onsite storage capacity.

Collected water would be considered RCRA hazardous waste and would be hauled offsite to a RCRA-permitted treatment facility. See Section 4.1.1.1 for a description of the offsite disposal ARARs for groundwater and the ARAR assessment used in this evaluation.

The RCRA cap, verification monitoring, and long-term monitoring would be as specified in the Consent Decree. A 10-year operating period plus 7 years of monitoring has been included in the cost estimates.

4.1.1.1 Offsite Disposal ARAR for Groundwater

Groundwater collected at the site will be hauled offsite for disposal. The site groundwaters are assumed to be RCRA hazardous waste based on toxicity, although TCLP testing has not been performed to date. Groundwater VOC concentrations reported in the RI Report for the till wells indicate that many constituent concentrations are at ppm levels that typically represent exceedances based on TCLP testing. Deeper groundwater in the sand waterbearing zone has one or two orders of magnitude lower VOC levels, and would possibly be classified as non-RCRA wastewater. All of the groundwater will require confirmatory TCLP testing prior to acceptance at an offsite disposal facility.

Contaminated groundwaters, if hazardous, are generally subject to the Land Disposal Restriction (LDR) treatment standards. The most recent standards are promulgated in the Land Disposal Restrictions Phase II - Universal Treatment Standards, Final Rule, 40 CFR Parts 148, et al., September 19, 1994.

Offsite disposal will also require compliance with 40 CFR 300.440, Procedures for Planning and Implementing Off-Site Response Actions. The proposed disposal facility will be assessed by U.S. EPA or the applicable state agency to determine its acceptability to dispose of the contaminated groundwater from the CERCLA site. The applicable regulatory agency will be notified of the intent to dispose of site wastes at the designated facility at least 60 days prior to the planned disposal of the wastes.

4.1.2 Analyses

This alternative is judged to be generally protective of the public health and environment since the interceptor drain would be effective in ~~preventing~~ the offsite migration of contaminants from the shallow groundwater zone, and the RCRA-compliant cover would be both effective in eliminating long-term public and environmental exposures to underlying contaminants, and minimizing the infiltration of rainwater and the potential offsite migration of semivolatile organic compounds and metals. The contaminants collected in the drain would be hauled offsite for disposal at a suitable permitted facility.

RRA Alternative Number 1 meets the overall RRA objective of the Consent Decree, however, the time to achieve cleanup is expected to be long-term (greater than 10 years) because of the passive nature of the groundwater collection system. In fact, calculations in the RI Report indicate that it could take from 10 to 500 years for the VOCs to migrate from the eastern portion of the site to the unnamed ditch, based on existing, uncovered site conditions. Placement of a RCRA-compliant cover would effectively eliminate groundwater recharge by precipitation, and thus would increase even further the VOC migration time. This long-term cleanup period is not consistent with the CERCLA preference for treatment and destruction of contaminants over a relatively short-term period.

This alternative is technically feasible and the remediation equipment and materials are readily available. Conventional excavating equipment, with the possible use of slurry-trench or other trench support methods, is expected to be applicable to construct the interceptor drain at an average depth of 15 feet.

Administrative feasibility is not expected to significantly inhibit implementation of this alternative. Site access and easements have been obtained with the property owner of the affected property, including access to the site from the main public access route, State Route 421. Impacts on adjoining property owners are not expected to be significant, since disturbance of subsurface contaminants would be relatively minor, although long-term.

Construction costs for this alternative are estimated to be $2.5 million based on a conceptual design planning cost accuracy (+50, -25 percent). Annual operation, maintenance, and monitoring costs are estimated to be approximately $850,000 (year 1), primarily because of the cost of offsite disposal of contaminated water. Heritage Environmental in Indianapolis, Indiana was used as the wastewater disposal facility in the cost estimate. Present-worth costs have been estimated at $8.8 million and are relatively high because the O&M period will be relatively long (17 years) compared to the other alternatives. See Appendix A for details on the construction, operation and maintenance, and present-worth costs.

4.2 RRA Alternative Number 2

4.2.1 Description

RRA Alternative Number 2 is basically the Consent Decree remedial action with modifications to the remediation of the southern concrete pad area (Site Area C). This would involve excavation of the southern concrete pad, aggregate subbase, and underlying subsoils to a depth of 9 feet or greater, depending on the results of field observations of visible contamination. Approximately 13,500 cubic yards of material would be removed. The excavated materials would be hauled offsite for disposal at a RCRA-permitted landfill. RRA Alternative Number 2 is shown on Figure 4-2. Pre-treatment to meet the U.S. EPA Land Disposal Regulation has not been included in the cost estimate. See Sections 4.1.1.1 and 4.2.1.1 for a description of the offsite disposal ARARs and the ARAR assessment used in this evaluation.

The soil excavation in the eastern half of the concrete pad area will require a grouted sheet pile cutoff wall and internal dewatering prior to commencing the excavation to reduce the potentiometric surface within the sand waterbearing zone and prevent uplift of the excavation bottom. Dewatering includes removal of 250,000 gallons of stored water within the concrete pad subbase and subsoils plus maintenance dewatering of the sand waterbearing zone within the cutoff wall during excavation. The maximum discharge rate for the sand waterbearing zone, without a cutoff wall, has been estimated at 40 gpm, based on a hydraulic conductivity of 10^{-2} cm/sec and a storage of 0.001. The maintenance dewatering rate during excavation is estimated at 4 gpm over a 2-week excavation and backfill period, or a total of 80,000 gallons. This rate is based on a 90 percent leakage reduction factor for a grouted steel sheet wall. Determination of the actual hydraulic characteristics of the sand waterbearing zone will require long-term pumping tests.

All collected water would be considered RCRA hazardous waste and would be hauled offsite to a RCRA-permitted treatment facility or treated onsite and discharged.

Other major components of RRA Alternative Number 2 include the following:

- SVE System in the North Areas A and B (2.35 acres) using trenches spaced on 18-foot centers to an average depth of 10 feet. The SVE system includes vapor phase carbon treatment and offsite disposal of groundwater at a RCRA treatment facility at an average discharge rate of 1.5 gpm (see Phase II Supplemental Investigation Report). An operating period of 1 year is estimated.

- A low permeability barrier between the Area C excavation and Area B, consisting of a continuous HDPE membrane. The barrier would be approximately 12 feet deep and 300 feet in length. The barrier wall would prevent the potential seepage of contaminated water and vapors between Area B and the clean soil backfill in Area C.

- Backfill of Area C to existing grade with approximately 10,000 cubic yards of clean soil fill assumed to be available at an onsite borrow area.

- A modified RCRA cap that includes replacement of the synthetic membrane (60-mil HDPE) with a low permeability soil and modification of the cap installation to install only the SVE surface seal during SVE operation. Rationale for the cap modifications and details of the cap construction are contained in Section 4.2.1.2. [illegible]

- Quarterly monitoring for 1 year operations plus post-cleanup semi-annual monitoring for 7 years of 14 groundwater wells and 3 surface water stations for the organic and inorganic parameters as listed in Exhibit A, Table 3-1.

4.2.1.1 Offsite Disposal ARARs for Excavated Materials

The southern concrete pad, subbase aggregates, and underlying subsoils excavated from the site southern area will be hauled offsite for disposal. These materials are assumed to be RCRA hazardous waste based on toxicity, although TCLP testing has not been performed to date on these materials. The soil VOC concentrations reported in the RI Report indicate that many constituent concentrations in the soil are at ppm levels that typically represent exceedances based on TCLP testing. No data is available from the RI Report or other sources on the concrete or aggregate (debris). All of these materials will require confirmatory TCLP testing prior to acceptance at an offsite disposal facility.

Contaminated soils and debris are generally subject to the Land Disposal Restriction (LDR) treatment standards. The most recent standards are promulgated in the Land Disposal Restrictions Phase II - Universal Treatment Standards, Final Rule, 40 CFR Parts 148, et al., September 19, 1994.

Offsite disposal will also require compliance with 40 CFR 300.440, Procedures for Planning and Implementing Off-Site Response Actions. The proposed disposal facility will be assessed by U.S. EPA or the applicable state agency to determine its acceptability to dispose of the contaminated soils and debris from the CERCLA site. The applicable regulatory agency will be notified of the intent to dispose of site wastes at the designated facility at least 60 days prior to the planned disposal of the wastes.

4.2.1.2 RCRA Cap Modifications

The RCRA cap described in the Consent Decree has been modified. These modifications and their rationale are as follows:

1. Allow for the option of substituting 2 feet or greater of low permeability soil for the low permeability soil/HDPE composite described in the Consent Decree, Exhibit A.

   Rationale:

   - Meets RCRA Closure ARAR.
   - Provides greater resistance to uplift from SVES air pressure.
   - Provides suitable surface seal for SVES.
   - Minimizes cap repair efforts if penetrations are necessary after installation.

2. Substitute geosynthetic drainage layer for 6 inches sand layer.

Rationale:

- Greater flow capacity at reduced cost.

3. Timing:

- Install SVES surface seal (soil only) during SVES operation.
- Install remaining cap after verification of soil cleanup.

Rationale:

- Eliminates penetrations of geosynthetic material for both SVES operations and soil cleanup verification.

The RCRA-compliant final cover will be placed over the SVE treatment areas and possibly the backfilled excavation. The cover will be placed in two stages as follows:

- Stage 1 - SVE surface seal installed prior to SVE operation.
- Stage 2 - Final cover installed after completion of SVE operations and verification of soil cleanup (approximately 1 to 3 years after placement of the Stage 1 cover).

The first stage cover will consist of a minimum of 3-foot of compacted, impermeable native soil and 1 foot of top soil to support vegetation. The final grading plan will ensure a minimum cover slope of 3 percent. The native soil used will be the silty clay till available in the area, which can and will be compacted by suitable methods to 95 percent maximum density as determined by ASTM D-1557-78. The compacted silty clay till will have a hydraulic conductivity less than or equal to the natural tills underlying the site. If soil from the neighboring Northside Sanitary Landfill Facility borrow area is not available, material with similar performance will be obtained from another source. Topsoil will consist of friable, fertile soil of loamy character, containing an amount of organic matter normal to the region, reasonably free from subsoil, roots, heavy or stiff clay, stones larger than 2 inches, and other deleterious matter, and capable of sustaining healthy plant life.

The Stage 1 cover will facilitate installation of SVE trenches and/or wellpoints during both construction and operation of the SVE system. Repairs to the soil cover penetrations can be easily made by either replacement of the compacted native soil or backfill with a low permeability bentonite-based grout.

The second stage final cover will consist of a geocomposite drainage net placed on top of the Stage 1 native soil layer with a minimum of 1 foot of soil fill and 1 foot of topsoil placed on top of the drainage net. The topsoil and vegetation placed for the Stage 1 cover will be stripped off, temporarily stockpiled, and then replaced on top of the 1 foot of soil fill and drainage net. The soil fill will consist of a suitable soil material, free from rock fragments greater than 2 inches, debris, and other deleterious substances.

The geocomposite drainage net will be an HDPE geonet surrounded on both sides with a nonwoven geotextile. The drainage net will have a minimum transmissivity of 0.01 ft^2/sec, which is significantly greater than the transmissivity of a 6-inch sand drainage layer which is specified in Exhibit A.

4.2.2 Analyses

This alternative is judged to be generally protective of the public health and environment. Excavation and offsite disposal of the southern concrete pad area, with subsequent SVE treatment and capping of the remaining site area, would be effective in ~~eliminating~~ long-term public and environmental exposures to underlying contaminants. SVE would reduce contaminant levels in the soil to the 10^{-6} or less cancer risk level for direct contact with the soil. The cap would also minimize the infiltration of rainwater and the potential offsite migration of semivolatile organic compounds and metals. SVE treatment has been demonstrated to be effective in removing significant quantities of VOCs from the site based on pilot studies conducted in 1988. The potential exposures to remedial workers during excavation operations can be effectively managed by appropriate employment of safety equipment and monitoring instruments.

Additionally, RRA Alternative Number 2 meets the overall RRA objective of the Consent Decree, and is consistent with the CERCLA preference for treatment and destruction of contaminants over a relatively short-term period. The time to achieve cleanup standards is estimated to be 1 to 3 years. One year has been used in the operation and maintenance cost estimate for present-worth costing.

This alternative is technically feasible and the remediation equipment and materials are readily available. Conventional excavating equipment is expected to be applicable to remove the concrete pad and subbase soils to a depth of approximately 9 feet. Offsite disposal capacity for approximately 13,500 cubic yards is expected to be readily available at local RCRA landfill facilities (Fort Wayne, Indiana).

Implementation of this alternative will be achieved by placement of a grouted steel sheet cutoff wall into the sand waterbearing zone with internal dewatering, which will enable excavation to 9 feet, or greater, in site areas where sand deposits are shallow and may restrict open excavations. Sheet pile cutoff walls with dewatering employ conventional technology that has been used at numerous excavation and foundation projects in similar applications. Final placement of the cutoff wall in the field will require additional site data to delineate the depth and thickness of the sand waterbearing zone and its hydraulic characteristics.

Administrative feasibility is not expected to significantly inhibit implementation of this alternative. Site access and easements have been obtained with the property owners. Potential impacts on adjoining property owners from particulate and VOC emissions may be more significant than the no-excavation alternatives, however, air emissions modeling demonstrates that local receptor exposures are within the U.S. EPA acceptable levels for carcinogenic and non-carcinogenic contaminants. Air emissions monitoring would be implemented and control measures, if necessary, would be employed to prevent any potential public exposures to site contaminants. Additional contingency planning would be required for transport of contaminated materials offsite to the final disposal facility.

Construction costs for this alternative are estimated to be $6.8 million based on a conceptual design cost accuracy (+50, -25 percent). Offsite disposal of approximately 24,000 tons of material is estimated to be approximately $3.0 million and is a major cost component for this alternative.

Chemical Waste Management, Adams Center Facility, Fort Wayne, Indiana was used as the solid hazardous waste disposal facility, and Heritage Environmental, Indianapolis, Indiana was used as the liquid waste disposal facility in the cost estimate.

Annual operation, maintenance, and monitoring costs are estimated to be approximately \$800,000 (year), primarily because of the cost of SVE treatment and offsite disposal of contaminated water. Present-worth costs have been estimated to be \$8.4 million and are relatively high because of the high capital costs, although the O&M period will be short (<1 year) compared to the other alternatives. See Appendix A for cost details.

4.3 RRA Alternative Number 3

4.3.1 Description

RRA Alternative Number 3 is basically the same as RRA Alternative Number 2 except that the excavated material from the concrete pad area would be placed onsite in the northern area for SVE treatment. All of the remedial components for the southern concrete pad area as described under RRA Alternative Number 2 are applicable to RRA Alternative Number 3 (see Section 4.2.1).

RRA Alternative Number 3 includes additional remedial components beyond RRA Alternative Number 2 and modification of the Remedial Action Plan as a result of placing the excavated material onsite. These include the following:

- Crush concrete pad pieces with a maximum dimension of 3 inches, and place the crushed concrete along with the aggregate subbase in a segregated treatment zone in the northern end of the site. The concrete pads and subbase aggregate at the former process building and at the former entrance road to the facility shall also be removed, crushed, and combined with the crushed southern concrete pad for SVE treatment.

- SVE by the trench method as described in the Consent Decree might not be the most appropriate approach to address the potential differential permeability conditions in the soil fill in the northern area. In addition, the increased thickness of the SVE treatment zone in the northern site area (14 to 17 feet) as a result of the additional fill placement will increase the costs of SVE trench construction. SVE extraction wells may be more applicable to site conditions since they can be installed easily to depths of 17 feet and they can be selectively screened across any vertical interval. Wellpoints offer an additional advantage in that they can be easily placed if necessary during operation of the SVE system to improve VOC removal efficiency in the treatment zone. Accordingly, a flexible SVE treatment approach is necessary.

The SVE treatment system is based on a performance-based specification that will outline the general SVE process required and the treatment criteria that have to be met. Either trenches, wellpoints, or a suitable combination of both may be used. This approach allows for SVE contractor involvement in the SVE design and provides the best opportunity for a cost-effective SVE system operation based on the site conditions.

- Semi-annual monitoring for the operations period plus post-cleanup semi-annual monitoring for 7 years of 14 groundwater wells and 3 surface water stations for the organic and inorganic parameters as listed in Exhibit A, Table 3-1. The frequency of monitoring during operations has been reduced from the quarterly requirements in the Consent Decree to a proposed semi-annual frequency. This modification is based on extending SVE operations to a 2-year period, compared to the 1 year estimate (360 days) in the Consent Decree (Appendix C), because of the wet soil conditions in the fill materials from the southern area excavation.

RRA Alternative Number 3 is shown as Figure 4-3.

4.3.2 Analyses

RRA Alternative Number 3 is effectively similar to RRA Alternative Number 2 and is judged to be protective of the public health and environment. Excavation and onsite treatment of the southern concrete pad area, with subsequent SVE treatment and capping of the remaining site area, would be effective in eliminating long-term public and environmental exposures to underlying contaminants. SVE would reduce contaminant levels in the soil to the 10^{-6} or less cancer risk level for direct contact with the soil. The cap would also minimize the infiltration of rainwater and the potential offsite migration of semivolatile organic compounds and metals.

SVE treatment has been demonstrated to be effective in removing significant quantities of VOCs from the site based on pilot studies conducted in 1988. The potential exposures to remedial workers during excavation operations can be managed by employment of appropriate safety equipment and monitoring instruments.

SVE treatment of the materials excavated from the southern concrete pad area is expected to be technically feasible. Generally, it is expected that the crushed concrete pad and subbase aggregate will be wet, however, these materials are expected to dewater quickly because of their relatively high permeabilities, and thus their residual moisture levels would not inhibit SVE. The excavated soils will also be wet and would not be expected to dewater as quickly. The degree of dewatering and drying will be affected significantly by the method of handling and placement. The Final Design should include methods for air drying, selective placement of the soils in thin lifts,and enhanced in-situ drying, as necessary, to minimize the problems with placement and SVE of the excavated soil material.

Additionally, RRA Alternative Number 3 meets the overall RRA objective of the Consent Decree, and is consistent with the CERCLA preference for treatment and destruction of contaminants over a relatively short-term period. The time to achieve cleanup standards is estimated to be 1 to 3 years. Two years has been used in the operation and maintenance cost estimate for present-worth costing.

This alternative is technically feasible and the remediation equipment and materials are readily available. Conventional excavating equipment is expected to be applicable to remove the concrete pad and subbase soils to a depth of 9 feet BGS.

Placement of a grouted steel sheet cutoff wall into the sand waterbearing zone with internal dewatering will enable excavation to 9 feet, or greater, in site areas where sand deposits are shallow and may restrict open excavations. Sheet pile cutoff walls with dewatering employ conventional technology that has been used at numerous excavation and foundation projects in similar applications. Final design of the cutoff wall and dewatering system will require additional site data to delineate the depth and thickness of the sand waterbearing zone and its hydraulic characteristics.

Administrative feasibility is not expected to significantly inhibit implementation of this alternative. Site access and easements have been obtained with the property owner. Potential impacts on adjoining property owners from particulate and VOC emissions may be more significant than the no-excavation alternatives, however, air emissions modeling demonstrates that local receptor exposures are within the U.S. EPA acceptable levels for carcinogenic and non-carcinogenic contaminants. The air emissions estimates and the excavation ambient air VOC emission risks are presented in the Preliminary Design (30 Percent) Report. Air emissions monitoring would be implemented and control measures, if necessary, would be employed to prevent any public exposures to site contaminants.

Construction costs for this alternative are estimated to be $3.4 million based on a conceptual design cost accuracy (+50, -25 percent).

Chemical Waste Management, Adams Center Facility, Fort Wayne, Indiana was used as the solid hazardous waste disposal facility, and Heritage Environmental, Indianapolis, Indiana was used as the liquid waste disposal facility in the cost estimate.

Annual operation, maintenance, and monitoring costs are estimated to be approximately $800,000 (year 1), primarily because of the cost of SVE treatment and offsite disposal of contaminated water. Present-worth costs have been estimated at $5.6 million and are relatively low because the O&M period will be short (<3 years) compared to the other alternatives. See Appendix A for cost details.

4.4 RRA Alternative Number 4

4.4.1 Description

RRA Alternative Number 4 is essentially the Consent Decree Remedial Action with modifications to attempt to address a significantly higher rate of dewatering the shallow groundwater during the 2 years of SVE operation. This higher rate is based on the preliminary findings of the concrete pad area investigations which indicate that a shallow sand deposit is present on the eastern side of the concrete pad, and this sand is potentially hydraulically connected to the sand waterbearing zone beneath the till (see Section 2.1). Dewatering would be performed continuously during remedial action to achieve an unsaturated zone of 9 feet minimum, which will allow SVE in the designated zone of treatment. This alternative is similar to the SVE alternative in the Feasibility Study (FS), except that the SVE system would be extended to a depth of 9 feet whereas the FS alternative included SVE to a depth of 5 feet.

In this alternative the Consent Decree Remedial Action has been modified to include an onsite storage and transfer system for the increased volume of collected groundwater. The SVE trench system would be used to collect shallow groundwater, which would be removed by vacuum well points placed in each SVE trench. The dewatering rate to maintain a 9-foot unsaturated zone has been estimated at between 7.5 and 43.5 gpm. The low end of this range is based on flow from the till zone of 3.5 gpm, as estimated in the Phase II Supplemental Investigations, plus the minimum flow estimate of 4 gpm from the sand waterbearing zone as a result of the SVE trenches penetrating the sand in the eastern part of the concrete pad area. The upper end of this range includes the till discharge plus the maximum flow estimate of 40 gpm from the sand waterbearing zone.

Prior to the concrete pad area investigations, the shallow sand deposits were not suspected to be present within the interval 0 to 9 feet BGS. The dewatering rate previously estimated based on these conditions was 5.5 gpm (Phase II Supplemental Investigation). The recent data indicates that, because of the presence of shallow sand deposits, potentially over the eastern half of the concrete pad area, the dewatering rate to operate a SVE system could increase an order of magnitude above the previous estimate.

All collected water would be considered RCRA hazardous and would either be treated onsite or be hauled offsite to a RCRA-permitted facility. See Section 4.1.1.1.

The RCRA cap, verification monitoring, and long-term monitoring would be as specified in the Consent Decree.

4.4.2 Analyses

This alternative would follow the FS evaluation of the SVE alternative (FS Alternative Number 5) with minor revisions for effectiveness of the SVE system.

SVE treatment in a dewatered saturated zone (approximately 5 to 10 feet BGS) cannot be said to be technically feasible in the pad area of this site based on all of the information known to date. Data regarding the shallow groundwater zone hydraulic characteristics is limited and no pilot studies using SVE in an active dewatered saturated zone have been performed to prove its feasibility under the conditions that have been shown to exist. In the absence of a carefully modeled pilot study demonstrating feasibility of achieving Consent Decree limits, the loss of efficiency of the SVE system due to the high moisture conditions renders achievement of Consent Decree cleanup standards problematic. Additionally, the large scale dewatering for a prolonged period that would be required to attempt this remedy, would result in grossly excessive treatment costs.

Generally, it is expected that the clayey glacial till will not be dewatered quickly and that soil moisture will be present in the dewatered interval (5 to 10 feet BGS) for an approximate 3- to 6-month period. This residual soil moisture will result in greater amounts of extracted water vapor during the initial SVE operations and reduced extraction rates for VOCs as a result of moisture present in soil pore space. Quantification of the SVE operations effects under this scenario cannot be made based on the limited site data. For costing purposes, the SVE operating period has been estimated to be 2 years, which is 1 year longer than SVE Alternative Number 2 and the same period for RRA Alternative Number 3. A considerably longer period of operation may be required due to loss of efficiency of the SVE system.

A significant added factor is the increased site preparation and dewatering costs related to construction of SVE trenches into the suspected sand waterbearing zone that is less than 9 feet BGS in the eastern area of the concrete pad. Temporary dewatering and/or cutoff walls would be required to construct the trenches into the sand zone to prevent blowout of the trench bottom. Sheet pile cutoff walls have been included under this alternative for costing purposes.

The maintenance dewatering rate during SVE operations has been estimated at 25 gpm, which is the median rate within the range of 7.5 to 43.5 gpm. Heritage Environmental, Indianapolis, Indiana, was used as the liquid waste disposal facility for cost estimating purposes. At this flow rate, onsite treatment options might be less costly for a 2-year operational period. Bench-scale treatability studies, process evaluations, and costing would need to be performed to accurately evaluate the onsite option. Moreover, any cost savings may be offset by underestimation of the time necessary to operate the SVE system due to increased soil moisture conditions.

Construction costs for this alternative are estimated to be $3.2 million based on a conceptual design cost accuracy (+50, -25 percent).

Annual operation, maintenance, and monitoring costs of $7.0 million (Year 1) are significantly higher than all other alternatives, primarily because of the costs for offsite disposal of contaminated groundwater. Present-worth costs have been estimated at $ 17.0 million, again because of the high annual costs for this alternative. See Appendix A for cost details.

4.5 RRA Alternative Number 5

4.5.1 Description

This alternative consists of air sparging combined with overlying vapor extraction to treat in-situ volatile organic compounds in the concrete pad area. Essentially, this should involve installing a series of shallow sparge wells into the shallow water bearing zone beneath the concrete pad area. A series of vapor extraction wells would then be installed within the vadose zone above the sparge area. The sparge wells would inject air under pressure into the saturated zone to volatilize and biodegrade the VOC compounds present within the water and soil matrix in this area. The overlying vapor extraction unit would then collect the vapors generated by sparging by applying a vacuum to the overlying soils. The vapors collected by the vapor extraction unit would then be passed through activated carbon prior to discharge to the atmosphere. Figure 4-4 is a schematic of a typical sparge/vapor extraction system.

4.5.2 Analyses

Air sparging with vapor extraction is effective in treating the volatile organic compounds present in the concrete pad area. This alternative works best in coarse-grained soils. The area of remediation, however, contains predominantly fine-grained deposits. This alternative is protective of public health and the environment by not allowing the offsite migration of volatile organic compounds and by reducing the toxicity/volume of contaminants beneath the pad area. Implementation and construction of this alternative will not create any air quality impacts, fugitive dusts, or transportation of hazardous materials. This alternative can be implemented in a relatively short time from (i.e., within 1 month of final remediation plan approval) without significant risk to workers or the public during construction and implementation.

The sparge/vapor extraction implementation in the concrete pad area is complicated by the subsurface conditions. Prior investigations have shown that saturated conditions occur within 1 foot of the top of the concrete pad. This condition does not provide a sufficient zone from which to extract the vapors generated by the sparge operation. The vapors therefore could potentially be spread outside of the remediation area which would increase mobilization and the area of VOC contamination. Additionally, the heterogeneity of the treatment zone (gravel fill, occasional sand lenses contained in silt/clay deposit) will likely create preferred pathways for the injected air which may prevent complete remediation and collection of vapors in the remediation area.

To overcome the lack of a sufficient vadose zone for vapor collection, clean fill could be added to create a thicker vadose zone or dewatering beneath the pad could be conducted to lower the water table to a point where a sufficient unsaturated zone could be created. However, building the area up with fill materials to create a vadose zone is not practical since the remediation area is covered with concrete which will effectively prevent collection of vapors from beneath the pad.

Dewatering beneath the pad area would require lowering the water table to approximately 5 feet below the pad to create a suitable unsaturated zone for vapor collection. To determine an adequate dewatering rate, field studies would be required. Preliminary estimates for dewatering to allow vapor recovery range from 1 to 2 gpm.

The heterogeneity of the soil creates a second complicating factor for successful sparging. Of particular concern are horizontal sand layers interbedded between silt/clay layers. Sparging in these conditions will likely create preferred pathways for the injected air and not offer any benefit to shallower contaminated soil. The predominantly fine-grained nature of the soil beneath the pad area does not provide the necessary conditions for successful sparging.

Based upon the facts that most of the soils are fine-grained, contain potential preferred pathways and would require partial dewatering to implement vapor extraction, this alternative is considered technically infeasible and will not be considered further.

5.0 COMPARATIVE ANALYSES OF REVISED REMEDIAL ACTION ALTERNATIVES

The four RRA Alternatives that were considered feasible for site implementation based on the analyses in Section 4.0 include the following:

- RRA Alternative Number 1 - Groundwater interceptor drain with the Consent Decree RCRA-compliant cover over the entire site area with no SVE treatment of soils in the site area north of the concrete pad ("additional work" measure described in Exhibit A).

- RRA Alternative Number 2 - Excavation of the southern concrete pad, aggregate subbase, and underlying subsoils with offsite disposal at a RCRA-permitted facility, and SVE treatment with the Consent Decree RCRA-compliant cover for the remaining site area.

- RRA Alternative Number 3 - Excavation of the southern concrete pad, aggregate subbase, and underlying subsoils and SVE treatment of these excavated materials in the northern site area, along with a RCRA-compliant covering of the remaining site area.

- RRA Alternative Number 4 - Soil vapor extraction of the entire site area with shallow groundwater dewatering and the Consent Decree RCRA-compliant cover over the entire site area.

These four alternatives are evaluated relative to each other for the criteria used in the alternatives analyses: effectiveness, implementability, and cost.

RRA Alternative Numbers 2, 3, and 4 were considered the most effective for short-term (<3 years) cleanup of the site organic contaminants and reduction of the toxicity, mobility, and volume of these contaminants. RRA Alternative Number 1 does not meet the CERCLA goal for short-term remediation since the time to achieve cleanup is expected to be long-term (>10 years).

RRA Alternative Numbers 2 and 3 are expected to be more effective than RRA Alternative Number 4 in the short-term because of the additional time required in RRA Alternative 4 to dewater the saturated tills and remove the residual soil moisture prior to SVE being effective throughout the treatment zone.

RRA Alternative Numbers 2 and 3 are similar in all respects except that the excavated materials would be hauled offsite in RRA Alternative Number 2 versus being treated onsite in RRA Alternative Number 3. Effectiveness and implementability are similar, with the exception that offsite disposal of contaminated materials presents an added potential risk to the public and the environment from possible spillage during transportation.

All four alternatives include offsite disposal of collected groundwaters. RRA Alternative Numbers 1 and 4 have significantly greater disposal volumes (2 gpm and 25 gpm, respectively) over the remediation operating period compared to RRA Alternative Numbers 2 and 3, which have short-term wastewater disposal volumes during remedial construction and relatively low disposal volumes (< 1.5 gpm) during remedial operations.

All of the four alternatives are considered technically feasible and each employs conventional, available technologies. RRA Alternative Number 5 has been eliminated because air sparging in the southern concrete pad area is not considered technically feasible.

Cost estimates for each of the Remedial Action Alternatives are contained in Table 5-1. These include capital, annual (O&M), and present-worth costs. Cost details are contained in Appendix A.

Capital costs for RRA Alternative Numbers 1, 3, and 4 are similar and range from $2.5 to $3.4 million. RRA Alternative Number 2 capital cost of $6.8 million is significantly larger than the other alternatives because of the offsite disposal of the excavated concrete pad and subsoils.

Annual costs for RRA Alternative Numbers 1, 2, and 3 range from $805,000 to $853,000. RRA Alternative Number 4 annual cost of $7.0 million (Year 1) is significantly higher than the other alternatives because of the offsite disposal of groundwater at a continuous rate of 25 gpm. This annual cost is over a 2-year estimated operation period.

Operational periods also vary among the alternatives, which subsequently affects the present-worth cost estimates. RRA Alternative Number 1 has an estimated operating period of 10 years, plus an additional 7 years of monitoring. RRA Alternative Number 2 has an estimated 1-year SVE operating period, with 7 additional years of monitoring. RRA Alternative Number 3 has an estimated 2 year SVE operation because of the extended time expected for dewatering and treating the relatively moist soil fill placed in the northern site area. RRA Alternative Number 4 has an estimated 2-year SVE operation because of the initial shallow groundwater dewatering phase. Seven years of monitoring is also included for RRA Alternative Numbers 3 and 4.

Present-worth costs for the alternatives indicate that RRA Alternative Number 3 is the least costly alternative. RRA Alternative Number 3 has a low present-worth cost primarily because of the relatively low capital cost and short operating period compared to the combination of these two cost items in the other Alternatives.

6.0 RECOMMENDED REVISED REMEDIAL ACTION

The analyses of the RRA Alternatives resulted in RRA Alternative Number 3 being recommended for implementation (see Section 4.3). This Alternative was selected because it: (1) is effective from a public health/environmental protection standpoint, (2) meets the remedial objectives for the site, (3) is consistent with the CERCLA preference for onsite treatment, (4) is technically and administratively feasible, and (5) is the most cost-effective alternative from a long-term viewpoint (present-worth).

The recommended RRA is summarized as follows.

Soil vapor extraction will only be employed over the northern and central areas of the site. The southern area of the site which includes a concrete pad, aggregate subbase, and subsurface soils will be excavated to the depths of 9 feet or greater as described in the Preliminary Design (30 Percent) Report and placed on the northern portion of the site for SVE treatment. The concrete pad will be crushed into pieces with a maximum dimension of 3 inches prior to placement on the northern portion of the site. A low permeability barrier will then be installed between the central and southern area of the site to minimize migration of subsurface water and/or vapor from the central area of the site to the southern area of the site. The excavation at the southern area of the site will then be backfilled with native soils.

The RRA accomplishes the same objective as described in the Consent Decree. The primary difference in approach is that the concrete pad and a portion of the onsite soils from the southern concrete pad area would be excavated and placed on the northern area of the site for SVE treatment. The northern and central site areas will be capped with a RCRA-compliant cover. The southern concrete pad area soils will be remediated by performing the following activities:

- Pressure grout the existing 20-foot by 20-foot by 12 feet deep sump (i.e., the ECC sump) located in the concrete pad area. The grouted interval will be from the floor of the excavation to the bottom of the sump.

- Crush the concrete pad into pieces with a maximum dimension of 3 inches, and place the crushed concrete along with the aggregate subbase in a segregated treatment zone in the northern end of the site. The concrete pads and subbase aggregate at the former process building and at the former entrance road to the facility shall also be removed, crushed, and combined with the southern concrete pad for SVE treatment. The treatment period is estimated at 2 years.

- Water collected in the sump and the excavation shall be disposed of offsite in accordance with Federal, state, and local regulations.

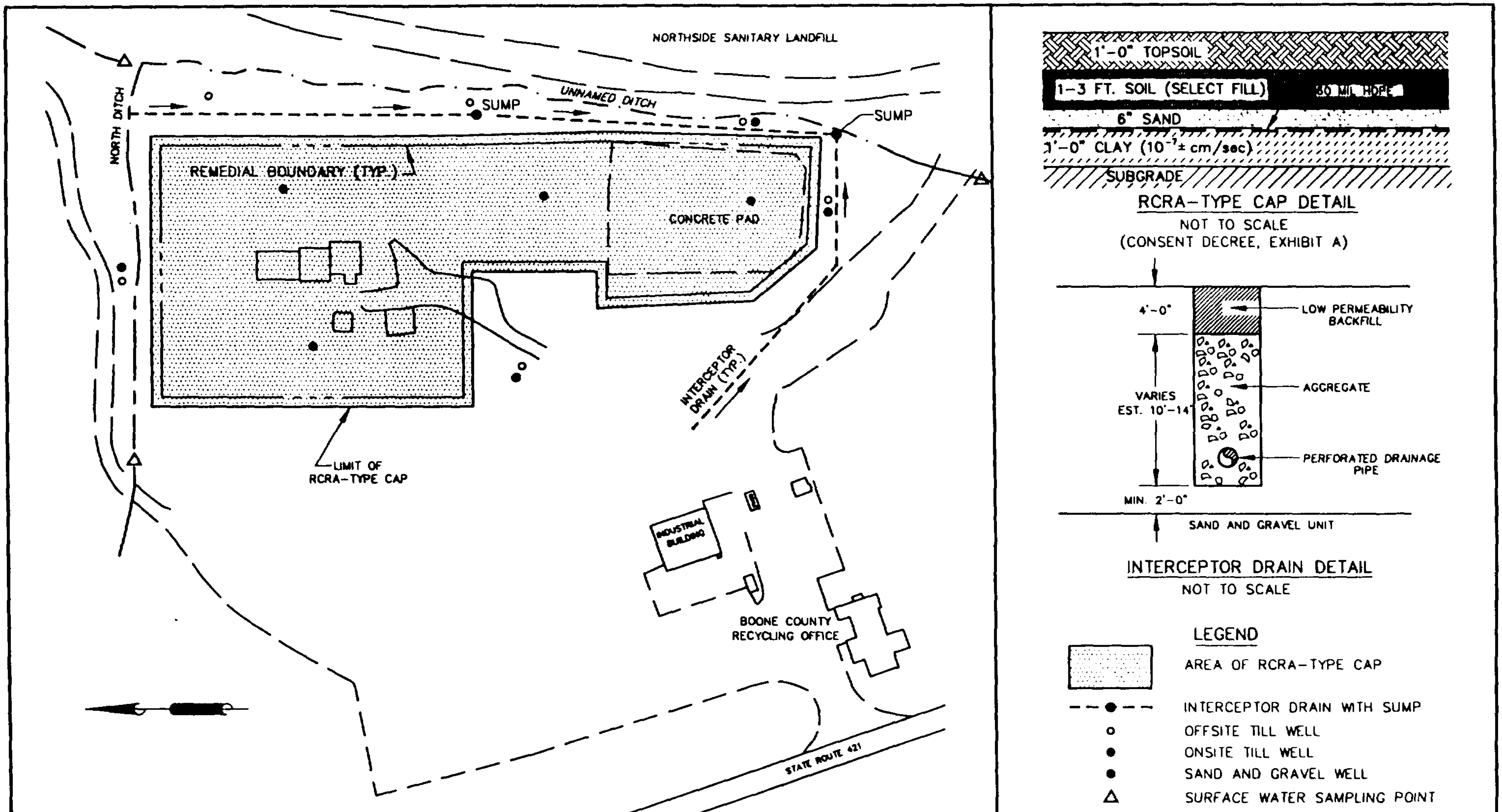
- Excavate the subsoils as described in the Preliminary Design.

- Install a low permeability barrier and drainage layer between the excavation and the SVE treatment area.

- Backfill the excavated area with native clay soils.

- Place a 12-inch layer of topsoil on the backfill soils in the excavated area and seed with appropriate vegetation, or place the RCRA-compliant cover over the backfill if required based on the results of any U.S. EPA post-excavation soil sample analyses.

FIGURES



ENVIRO-CHEM SITE PLAN

0 100 200
SCALE IN FEET

AWD TECHNOLOGIES, INC.

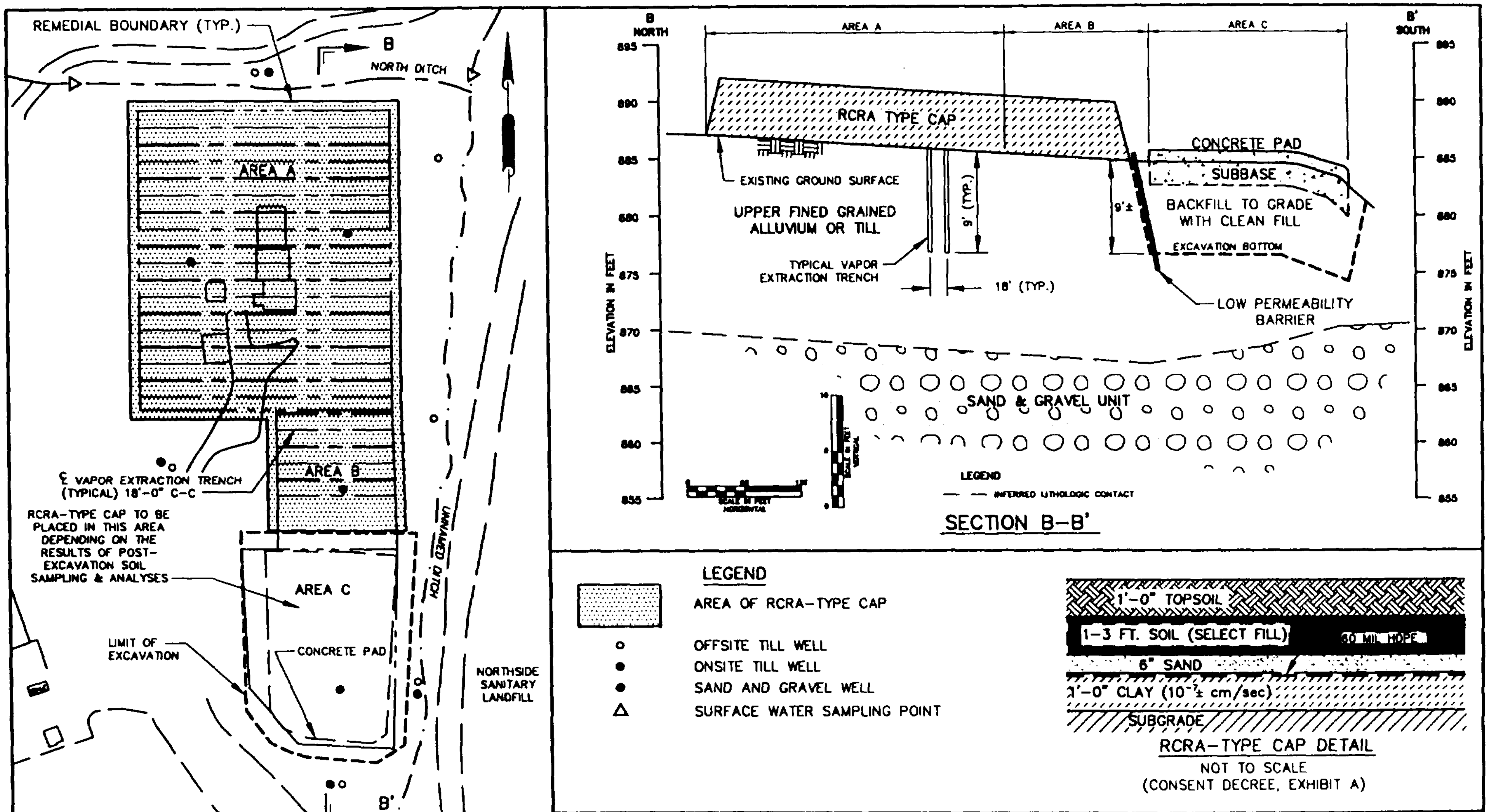
AWD TECHNOLOGIES

RRA ALTERNATIVE NO. 1

GROUNDWATER INTERCEPTOR DRAIN AND RCRA-TYPE CAP

ECC SUPERFUND SITE	ZIONSVILLE, IN
CLIENT: ENVIRONMENTAL CONSERVATION & CHEMICAL CORP. TRUST	JOB NUMBER: 2455-001
SCALE: AS SHOWN	FIGURE NUMBER 4-1
REV 0	

FILE: \ECC\RRA4-1.DWG



AWD TECHNOLOGIES, INC.

AWD TECHNOLOGIES

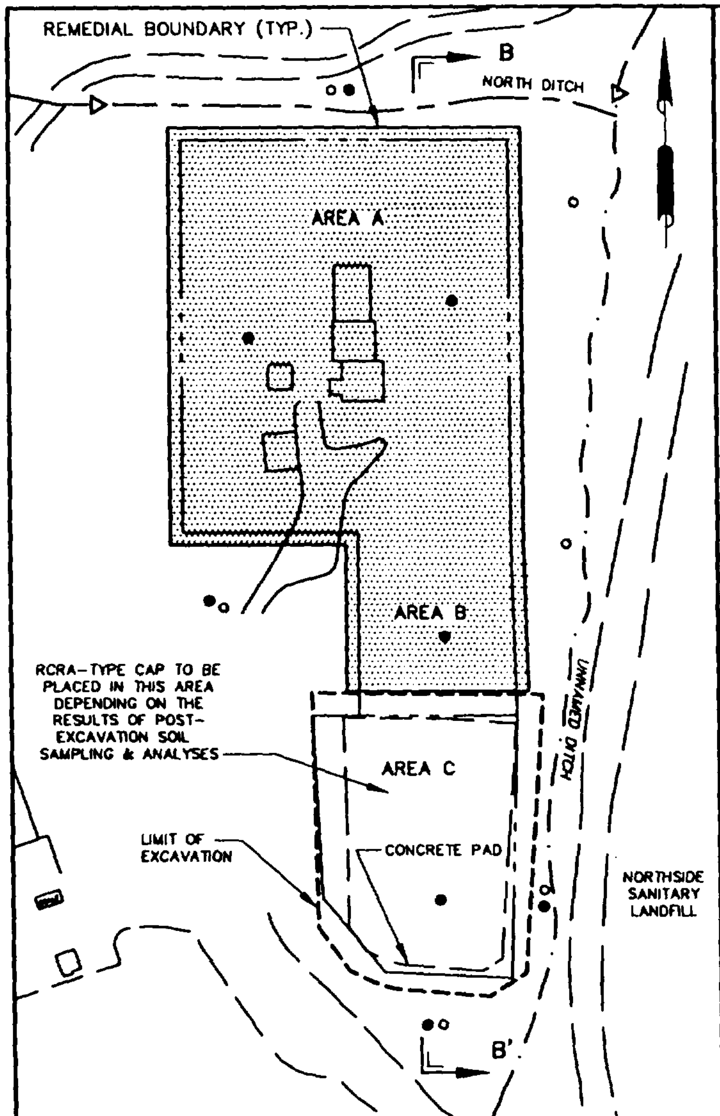
RRA ALTERNATIVE NO. 2

EXCAVATION OF AREA C, OFFSITE DISPOSAL OF CONCRETE, SUBBASE, & SOILS

ECC SUPERFUND SITE — ZIONSVILLE, IN

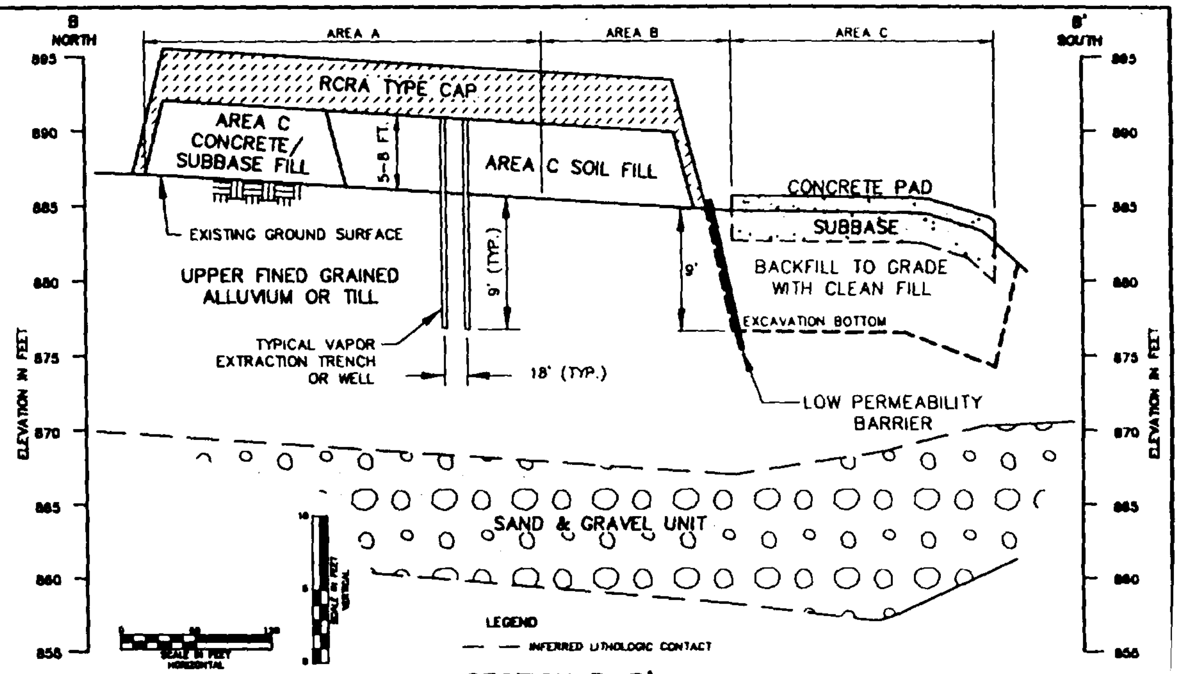
CLIENT: ENVIRONMENTAL CONSERVATION & CHEMICAL CORP. TRUST — JOB NUMBER: 2455-001

SCALE: AS SHOWN — FIGURE NUMBER 4-2 — REV 0



ENVIRO-CHEM SITE PLAN

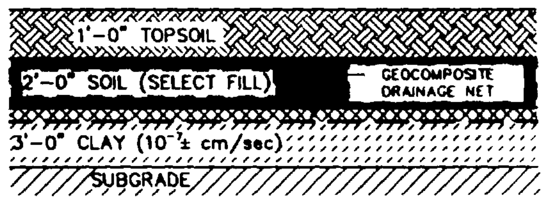
0 100 200
SCALE IN FEET



SECTION B-B'

LEGEND

- AREA OF RCRA-TYPE CAP
- ○ OFFSITE TILL WELL
- ● ONSITE TILL WELL
- ● SAND AND GRAVEL WELL
- △ SURFACE WATER SAMPLING POINT



RCRA-TYPE CAP DETAIL

NOT TO SCALE

AWD TECHNOLOGIES, INC.

AWD TECHNOLOGIES

RRA ALTERNATIVE NO. 3

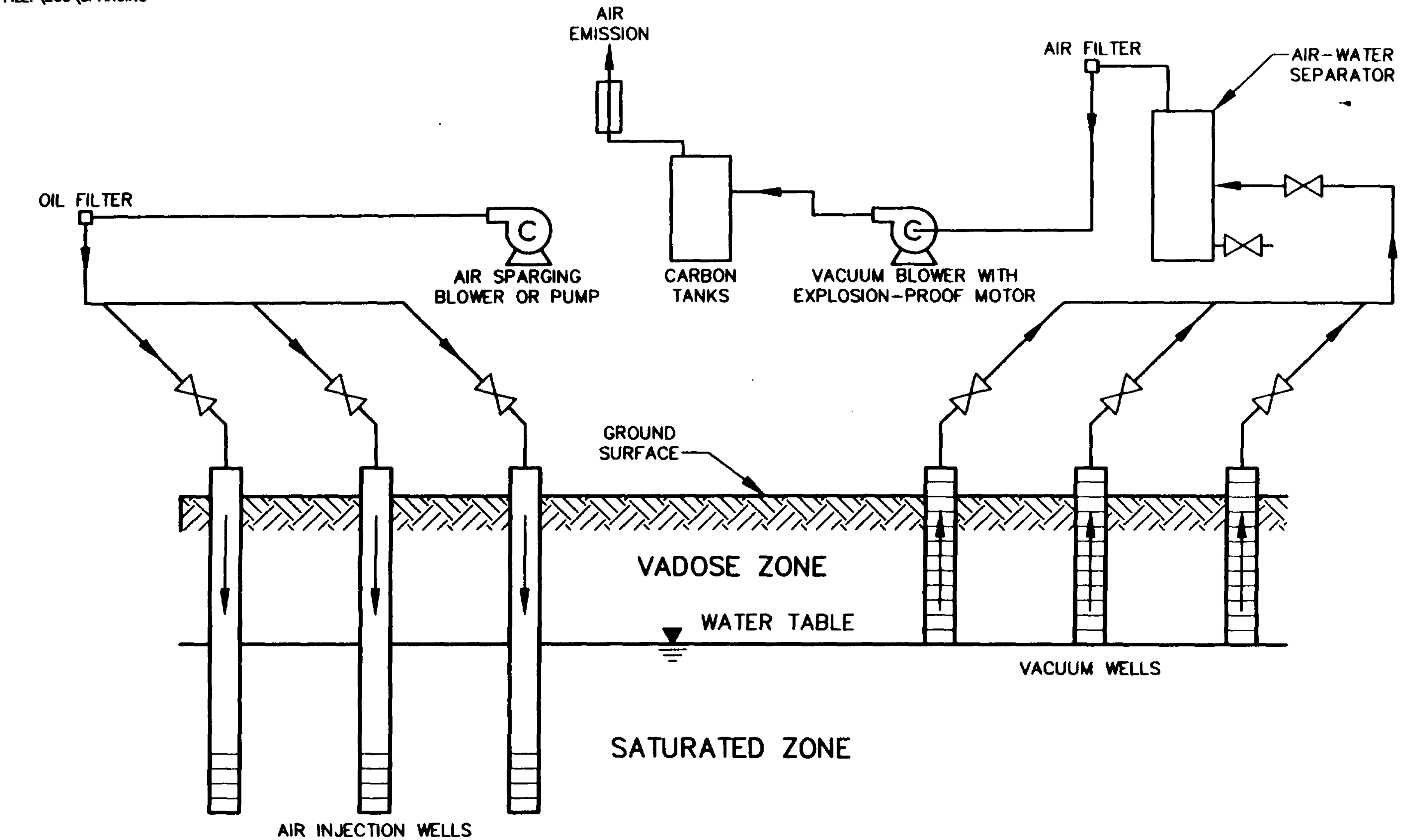
EXCAVATION OF AREA C, ONSITE DISPOSAL OF CONCRETE PAD & SUBBAS

ECC SUPERFUND SITE — ZIONSVILLE, IN

CLIENT: ENVIRONMENTAL CONSERVATION & CHEMICAL CORP. TRUST — JOB NUMBER: 2455-0

SCALE: AS SHOWN — FIGURE NUMBER 4-3 — REV 0

FILE: \ECC\SPARGING



1212 94RTH	0901 94GW

AWD TECHNOLOGIES, INC AWD TECHNOLOGIES	TYPICAL AIR SPARGING SYSTEM SCHEMATIC		
	ENVIRO-CHEM SUPERFUND SITE ZIONSVILLE, IN		
	CLIENT: ENVIRONMENTAL CONSERVATION & CHEMICAL CORP. TRUST	JOB NO: 2455-001	
	SCALE: NONE	FIGURE NUMBER 4-4	REV 0

TABLES

TABLE 5-1 REVISED REMEDIAL ACTION ALTERNATIVES COMPARATIVE COST SUMMARY[1] ENVIRO-CHEM SUPERFUND SITE				
Alternative Number	Capital Cost ($ x 1,000)	Annual Costs[2] ($ x 1,000)	Operating[3] Period (Years)	Present-Worth[4] Costs ($ x 1,000)
1	2.5	853	17	8,786
2	6.8	805	8	8,404
3	3.4	805	9	5,597
4	3.2	7,048	9	17,029

Notes

(1) Costs are based on conceptual designs and are budget planning estimates, cost accuracy is +50, -20 percent.

(2) Annual costs including operations, maintenance, and monitoring for year 1. These costs vary depending on operating year. See Table 5, Appendix A.

(3) Operating period includes remediation period plus 7 years of monitoring.

(4) Present-worth costs for the RRA operating period at an annual discount rate of 5 percent.

APPENDIX A

COST DETAILS (TABLES 1 THROUGH 5)

Table 1
Construction Cost Estimate
Remedial Alternative 1

Cost Item	Quantity	Unit	Unit Cost	Item Cost	Notes
1.0 Mobilization	1.0	ls	$75,000	$75,000	inc. site prep.
2.0 Interceptor Drain					
2.1 Trench/Aggregate (Includes Dewatering)	1,100.0	lf	$600	$660,000	10' avg depth
2.2 Sumps (2)	2.0	ea	$20,000	$40,000	
2.3 Mechanical/Piping	1.0	ls	$50,000	$50,000	
2.4 Electrical/Instrumentation	1.0	ls	$35,000	$35,000	
2.5 Storage Tank/Containment	1.0	ls	$50,000	$50,000	100,000 gallons
3.0 RCRA Type Cap	3.1	acre	$300,000	$930,000	
4.0 Monitoring Systems	1.0	ls	$90,000	$90,000	14wells
Subtotal				$1,930,000	
Engineering & QC (8%)				$154,400	
Contingency (20%)				$416,880	
Total				$2,501,280	

Table 2
Construction Cost Estimate
Remedial Alternative 2

Cost Item	Quantity	Unit	Unit Cost	Item Cost	Notes
1.0 Mobilization	1.0	ls	$100,000	$100,000	inc. site prep.
2.0 Dewatering & Offsite Disposal (area C)					
2.1 Excavation	250,000.0	gal	$0.50	$125,000	RCRA TSD
2.2 Wellpoints	80,000.0	gal	$0.75	$60,000	wellpoints and RCRA TSD
3.0 Area C Excavation					
3.1 Concrete/Subbase	3,500.0	cy	$20	$70,000	
3.2 Soils	10,000.0	cy	$15	$150,000	
3.3 Backfill	10,000.0	cy	$15	$150,000	local soils
3.4 Area A/B Fill	10,000.0	cy	$5	$50,000	
3.5 Cutoff Wall	21,000.0	sf	$15	$315,000	grouted steel sheets
4.0 SVE System					
4.1 Trench/Aggregate	4,800.0	lf	$60	$288,000	9 ft. depth
4.2 Mechanical/Piping	1.0	ls	$125,000	$125,000	
4.3 Blowers	2.0	ea	$16,000	$32,000	500 SCFM
4.4 Electrical/Instrumentation	1.0	ls	$120,000	$120,000	
4.5 Air/Water Separator	1.0	ls	$5,000	$5,000	
4.6 Vapor Treatment	1.0	ls	$50,000	$50,000	activated carbon
4.7 Water Storage	1.0	ls	$30,000	$30,000	20,000 gal tank
4.8 Building	1.0	ls	$50,000	$50,000	
5.0 Vertical Barrier	3,900.0	sf	$15	$58,500	60 mil HDPE
6.0 Offsite Disposal					
6.1 Concrete/Subbase	3,500.0	cy	$200	$700,000	
6.2 Subsoils	10,000.0	cy	$200	$2,000,000	
7.0 Monitoring	1.0	ls	$90,000	$90,000	
8.0 RCRA-Type Cap	2.4	acre	$300,000	$705,000	
Subtotal				$5,273,500	
Engineering & QC (8%)				$421,880	
Contingency (20%)				$1,139,076	
Total				$6,834,456	

Table 3
Construction Cost Estimate
Remedial Alternative 3

Cost Item	Quantity	Unit	Unit Cost	Item Cost	Notes
1.0 Mobilization	1.0	ls	$100,000	$100,000	inc. site prep.
2.0 Dewatering & Offsite Disposal (area C)					
2.1 Excavation	250,000.0	gal	$0.50	$125,000	RCRA TSD
2.2 Wellpoints	80,000.0	gal	$0.75	$60,000	wellpoints and RCRA TSD
3.0 Area C Excavation					
3.1 Concrete/Subbase	3,500.0	cy	$20	$70,000	place in area A
3.2 Soils	10,000.0	cy	$10	$100,000	place in areas A/B
3.3 Backfill/Compaction	10,000.0	cy	$15	$150,000	local soils
3.4 Area A/B Fill	10,000.0	cy	$5	$50,000	
3.5 Cutoff Wall	21,000.0	sf	$15	$315,000	grouted steel sheets
4.0 SVE System					
4.1 Trench/Aggregate	6,000.0	lf	$60	$360,000	areas A&B avg 14' depth
4.2 Mechanical/Piping	1.0	ls	$160,000	$160,000	
4.3 Blowers	2.0	ea	$16,000	$32,000	500 SCFM
4.4 Electrical/Instrumentation	1.0	ls	$150,000	$150,000	utility hookup
4.5 Air/Water Separator	1.0	ls	$5,000	$5,000	
4.6 Vapor Treatment	1.0	ls	$50,000	$50,000	activated carbon
4.7 Water Storage	1.0	ls	$30,000	$30,000	20,000 gal tank
4.8 Building	1.0	ls	$50,000	$50,000	
5.0 Vertical Barrier	3,900.0	sf	$15	$58,500	60 mil HDPE
6.0 Monitoring Systems	1.0	ls	$90,000	$90,000	14 monitoring wells
7.0 RCRA Cap	2.4	acre	$300,000	$705,000	
Subtotal				$2,660,500	
Engineering & QC (8%)				$212,840	
Contingency (20%)				$574,668	
Total				$3,448,008	

Table 4
Construction Cost Estimate
Remedial Alternative 4

Cost Item	Quantity	Unit	Unit Cost	Item Cost	Notes
1.0 Mobilization	1.0	ls	$100,000	$100,000	inc. site prep.
2.0 Dewatering & Offsite Disposal					
2.1 Excavation	50,000.0	gal	$0.5	$25,000	RCRA TSD
2.2 Wellpoints	80,000.0	gal	$0.75	$60,000	wellpoints & RCRA TSD
2.3 Cutoff Wall	21,000.0	sf	$15	$315,000	grouted steel sheets
3.0 SVE System					
3.1 Trench/Aggregate	6,000.0	lf	$60	$360,000	areas A&B avg 10' depth
3.2 Mechanical/Piping	1.0	ls	$160,000	$160,000	
3.3 Blowers	2.0	ea	$16,000	$32,000	500 SCFM
3.4 Electrical/Instrumentation	1.0	ls	$150,000	$150,000	utility hookup
3.5 Air/Water Seperator	1.0	ls	$5,000	$5,000	
3.6 Vapor Treatment	1.0	ls	$50,000	$50,000	activated carbon
3.7 Water Storage/Containment	1.0	ls	$50,000	$50,000	100,000 gal tank
3.8 Building	1.0	ls	$50,000	$50,000	
4.0 Monitoring Systems	1.0	ls	$90,000	$90,000	14 monitoring wells
5.0 RCRA Cap	3.5	acre	$300,000	$1,050,000	
Subtotal				$2,497,000	
Engineering & QC (8%)				$199,760	
Contingency (20%)				$539,352	
Total				$3,236,112	

Table 5
Operation and Maintenance
Estimated Costs - Annual Basis

Cost Item	Annual Costs							
	Alternative 1	Year	Alternative 2	Year	Alternative 3	Year	Alternative 4	Year
1.0 Monitoring								
1.1 Quarterly (17 sample locations)	$250,000	1	$250,000	1	$250,000	1	250,000	1
1.2 Semi-Annual (17 sample locations)	($125,000)	2 - 17	($125,000)	2 - 8	($125,000)	2 - 9	($125,000)	2 - 9
2.0 Water Disposal, RCRA TSD Offsite								
2.1 (1.5) GPM (788,400 GPY @ $0.5)			$394,200	1	$394,200	1 - 2		
2.2 (2.0) GPM (1,051,200) GPY @ $0.5)	$525,000	1 - 10						
2.3 (25) GPM (13,140,000 GPY @ $0.5)							$6,570,000	1 - 2
3.0 Interceptor Drain Operation & Maintenance								
3.1 (2) Sumps (electricity, cleaning)	$20,000	1 - 10	n/a		n/a			
3.2 Operator (10 hrs/week)	$30,000	1 - 10	n/a		n/a			
4.0 RCRA Cap Maintenance (3% of Construction)	$28,000	1 - 17	$21,000	1 - 8	$21,000	1 - 9	$28,000	1 - 9
5.0 SVE System (operator, electricity, carbon inc.)								
5.1 Area A & B (2.35 acres)	n/a		$140,000	1	$140,000	1 - 2		
5.2 Total Site (3.5 acres)	n/a		n/a		n/a		$200,000	1 - 2
Annual Costs	$853,000	1	$805,200	1	$805,200	1	$7,048,000	1
	($728,000)	2 - 10	($146,000)	2 - 8	($680,200)	2	($6,923,000)	2
	($153,000)	11 - 17			($146,000)	3 - 9	($153,000)	3 - 9